Particulate Air Pollution and Hospital Admissions for Congestive Heart Failure in Eight US Cities

Author(s): Gregory A. Wellenius, Joel Schwartz, John J. Godleski, Murray A. Mittleman

Affiliation(s): Harvard School of Public Health and Beth Israel Deaconess Medical Center, Boston, MA.

Introduction

Congestive heart failure (CHF) is a common endpoint of nearly every form of cardiac disease and accounts for almost 1 million hospital discharges and more than 50,000 deaths per year in the US.

Respirable ambient air particles (particulate matter with aerodynamic diameter < 10 µm, PM_{10}) may acutely exacerbate CHF and lead to hospitalization. However, this hypothesis has not been evaluated across multiple US cities in a systematic manner.

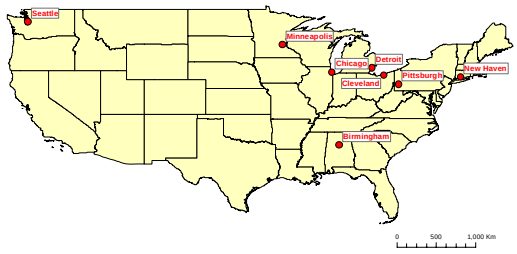
Methods

Cases: Medicare beneficiaries (age ≥ 65) residing in one of 8 metropolitan regions (Fig. 1) and hospitalized for CHF from the Emergency Department.

Exposure: We obtained daily measures of PM_{10} (EPA) and meteorological variables (NCDC) for each city.

Analysis: First, we used a time-stratified case-crossover design to separately estimate effect of PM_{10} on the risk of admission in each city. Second, we obtained a combined random-effects estimate from the city-specific estimates.

Figure 1: Map of Cities Included in Current Study



Results

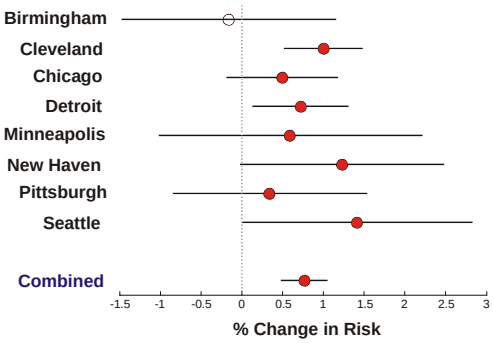


Figure 2: Overall, a 10 µg/m³ increase in PM_{10} was associated with a 0.77% (95 % CI: 0.48, 1.05) increase in risk of admission for CHF on the same day (combined n = 284,796 admissions). No association was observed with PM_{10} levels 1-3 days prior to admission.

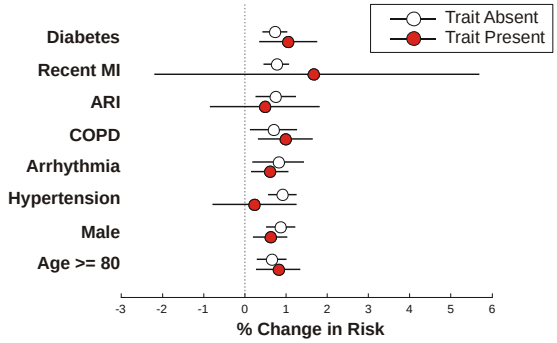


Figure 3: Each point represents the estimated change in risk (95% CI) of emergency hospitalization for CHF associated with a 10 µg/m³ increase in PM_{10} among patients with (red circles) or without (open circles) each trait. There was no consistent effect modification on the multiplicative scale by age, gender, or any secondary diagnosis evaluated.

Discussion

- Higher levels of particulate air pollution are associated with a transient increase in the risk of hospitalization for CHF
- There is no evidence that specific subgroups are more sensitive to these effects
- We are evaluating the mechanisms of these effects in a rat model of CHF

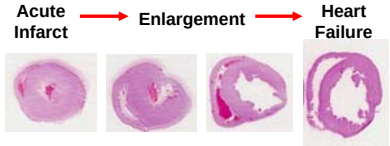


Figure 4: We are currently evaluating the mechanisms of the effects of concentrated ambient particles in this rat model of congestive heart failure. These images show the progression from acute myocardial infarct to ventricular dilation and heart failure.

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